B1 cnc'd.

compensator 8 is a control command signal S1. The control command signal S1 is input to a power amplifier 7, and a control current i following-up to the control command signal S1 is supplied to an electromagnet coil 6 of the electromagnet 4. At this time, the coil load of the electromagnet 4 is a delay load, so that the electromagnet 4 cannot follow the input signal. To improve the delay characteristics, the control current i of the electromagnet coil 6 is detected by a current sensor 11 to perform local feedback. That is, a control current detection signal Si detected by the current sensor 11 is fed back (negative feedback) to the input of the power amplifier 7 through a regulator 12.

Page 6, paragraph starting at line 23, has been amended as indicated below:

B2

Preferably, a control current detection signal of the current sensor is fed back to the power amplifier. This results in an addition, to a magnetic bearing apparatus according to the present invention, of a conventional voltage feedback type power amplifier system in which a control current detection signal of the current sensor is fed back to the power amplifier. Consequently, an industrial reliability can be improved.

Page 7, paragraph starting at line 29 and bridging over to page 8, has been amended as indicated below:

B3

Hereinafter, preferred embodiments of the present invention will be described in more detail with reference to the accompanying drawings. Fig. 4 is a diagram showing a structural example of a magnetic bearing apparatus in accordance with the present invention. In the magnetic bearing apparatus shown in Fig. 4, a displacement sensor 10 and an electromagnet 4 are disposed facing to

B3 concl'd.

a sensor target 2 and an electromagnetic target 3 of a supported member 1, respectively. The displacement sensor 10 is connected to a displacement sensor amplifier 9 and outputs a displacement detection signal Sg indicative of a gap length g between the displacement sensor 10 and the sensor target 2. A target position of the supported member 1 is given based on a displacement detection signal Sg and a target command signal θ_0. A control command signal S1 is outputted to a power amplifier 7 from a compensator 8.

Page 8, paragraph starting at line 25 and bridging over to page 9, has been amended as indicated below:

B4

Fig. 5 is a diagram for explaining a magnetic circuit of the electromagnet. The figure shows an example of a magnetic circuit that can ignore a leak magnetic flux. In the figure, a dotted line L denotes an average magnetic path. If there is no leak magnetic flux, the magnetic flux density B is represented by the following:

$$B=iN/\{(2g/\mu_O)+(1_m/\mu_O\mu_{S1})+(1_n/\mu_O\mu_{S2})\}\ [T] \quad (1)$$

If

$$(1_m/\mu_O\mu_{S1})+(1_n/\mu_O\mu_{S2})<<(2g/\mu_O) \quad (2)$$

then,

$$B\fallingdotseq(\mu_O iN)/(2g)\ [T] \quad (3)$$

where N denotes the number of turns of the electromagnetic coil; A a cross-sectional area of the electromagnetic yoke; i a current of an electromagnetic coil 6; g a gap between an end surface of the

B4

electromagnetic yoke and the electromagnetic target; 1_m an average magnetic path length on the electromagnetic yoke side; 1_n an average magnetic path length on the electromagnetic target side; B the magnetic flux density; φ the magnetic flux (φ=B · A); μ_O the vacuum magnetic permeability (the same in the atmosphere); μs_1 the specific magnetic permeability on the electromagnetic yoke; and μ_{S2} the specific magnetic permeability on the electromagnetic target.

Page 9, paragraph starting at line 10, has been amended as indicated below:

Since no leak magnetic flux exists in the electromagnetic yoke 5 having the sectional area A, the magnetic flux φ at the gap g between the end surface of the electromagnetic yoke 5 and the surface of the electromagnetic target 3 is equal to a product of the magnetic flux density B and the sectional area A. The equation (1) represents a relationship between the magnetic flux density and other parameters. The specific magnetic permeability μ_{S2} of the electromagnetic yoke and the specific magnetic permeability μ_{S2} of the electromagnetic target are variables of the intensity H of the magnetic flux density or magnetic field and the frequency thereof. Conventionally, there are a variety of applications where it is sufficient that those values are considered as constants. If these values cannot be ignored, the magnetic flux feedback type power amplifier structured as shown in Fig. 3 has been adopted.

Page 10, paragraph starting at line 12, has been amended as indicated below:

B5

A phase delay transfer function of the electromagnetic coil current and the magnetic flux ϕ

B5 cont'd.

and the magnetic flux density B can be represented by a transfer function equations of low pass filters shown in Figs. 7(a) and 7(b). Such a transfer function can be obtained by curve-fitting actual data and making a calculation of an equation, or can be simulated by a simple analog circuit. Fig. 7(a) shows the structure of a low pass filter using passive elements, and Fig. 7(b) shows the structure of a low pass filter using an operational amplifier.

Page 10, paragraph starting at line 23 and bridging over to page 11, has been amended as indicated below:

Fig. 8 is a diagram showing a structural example of the estimator 20. The following equations can be obtained from the relationship of the above equations (1) and (3):

$$B=K(i/g)f \qquad (4)$$

$$\varphi=BA \qquad (5)$$

where K is a gain constant defined by the number of turns of the electromagnetic coil 6, an adjustment gain and the like; and f is a characteristic of a simulator that simulates the delay characteristic by a method shown in Fig. 6. If at least the coil current i (the control current detection signal Si of the current sensor 11) and the gap length g between the end surface of the electromagnet yoke 5 and the electromagnet target 3 (the displacement detection signal Sg of the displacement sensor 10) are inputted to the simulator, it is possible to obtain a signal corresponding to the magnetic flux density B. Further, since the magnetic flux φ and the magnetic flux density B exhibit a relationship as indicated by equation (5), a signal corresponding to the magnetic flux φ can be obtained, if the sectional area A is included in the gain constant K.